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REPORT COVERING THE SURVEY OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE GALLATIN NATIONAL FOREST

1933

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Introduction

A heavy mortality occurred to the brood of the mountain pine beetle in lodgepole pine in western Montana during the winter of 1932-33. The first examinations to establish this mortality were made in June on the Beaverhead National Forest with subsequent examinations indicating this condition to be general over all southwestern Montana forests. From the Idaho-Montana line southward on the Targhee Forest the degree of winter mortality decreased.

In 1931 it was decided to abandon the Yellowstone Control Project which had for its objective the protection of the vast stands of lodgepole pine in and around the Yellowstone National Park. It seemed inevitable at that time that the tremendous infestations to the west and northwest would eventually sweep into this region in such volume as to make it economically unsound to continue protective efforts. However, as the heavy mortality of 1932-33 affected probably the greatest source of infestation it was decided to survey all of the forests concerned in the Yellowstone Project to determine first the status of the mountain pine beetle infestation and then the feasibility of reopening the project. To the Forest Insect Field Station of the Bureau of Entomology was given the responsibility for conducting surveys of the Beaverhead, Targhee and Gallatin Forests subsequent to the 1933 attacks under a cooperative agreement with the Forest Service. This report is of the Gallatin survey and is practically a duplication of those of 1931 and 1932, differing only in the larger area covered in 1933.

The survey included the Gallatin River drainage, the upper portion of the Madison River watershed outside of and adjacent to the western boundary

of the Yellowstone Park, the area drained by the west fork of the Madison River on the west side of the main drainage of the Madison north to Wall Creek and to Bear Creek on the east side, and that portion of the old Gallatin Forest on the west side of the Yellowstone River from the Park boundary north to Bozeman--in all a total of about 1,180,000 acres. This report not only gives the status of the infestation in 1933, but compares it with similar data for 1931 and 1932.

The entire region surveyed has been divided into units which usually embrace the drainages of one or more of the larger streams. These divisions facilitate comparison of the infestation for different years. Chart I is a small scale map showing the boundaries of these units.

GENERAL STATUS OF THE INFESTATION

The infestation is very light over the forest as a whole, showing what may be considered as a concentration of attack, arbitrarily set at .1 or more trees per acre, on only five of the fifteen units. Three of these units adjoin the Yellowstone Park on the north and west and the other two are on the old Madison Forest. The status of the infestation on these units for the three years in which surveys were made is shown in the discussion for each area given on succeeding pages of this report.

In comparing the amount of infestation by species for the different years it was found that in lodgepole pine there was a 15.8 percent increase in 1932 and a 22.9 percent decrease in 1933. The white-bark pine type shows a different condition. In 1932 there occurred a 28.6 percent increase over the preceding year and a 41.2 percent increase in 1933 over 1932. This may be more clearly seen in the following tabulation.

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION IN LODGEPOLE PINE AND WHITE-BARK PINE ON THE GALLATIN NATIONAL FOREST
1931 to 1933

Tree Species	Attacked Trees per Acre 1931	1932	1933	Percent Change in Status 1931-2	1932-3
Lodgepole Pine	.0212	.0245	.0189	15.6	-22.9
White-bark Pine	.0234	.0301	.0425	28.6	41.2

It is believed the decrease noted in lodgepole pine in 1933 in contrast to the increase in the white-bark pine type was due to the influence of the following factors on mortality caused by the extremely low temperatures of the winter of 1932-33:

(1) Difference in location of the two timber species. The lodgepole pine type usually occurs at a lower elevation and on more level situations than the white-bark pine. On such sites lower temperatures are believed to have occurred due to the tendency of cold to settle into them in the mountainous country.

(2) Snow, which protects the beetles in the base of the tree from extreme cold, was deeper at the higher altitude where white -bark pine grows and thus protected a larger proportion of the bark-beetle brood than in the lodgepole pine type at lower altitudes where snow was not so deep.

(3) It was found from examinations made on the Beaverhead Forest in 1933 that where lodgepole pine and white-bark pine occurred in mixture, more insects survived in the white-bark pine. The generally thicker bark of the white-bark pine probably offered more protection from extremes of temperature than did lodgepole pine.

Beside the preceding factors there is a possibility that the infestation already present in white-bark pine may have been augmented by beetles from outside sources during the summer of 1933.

STATUS OF INFESTATION ON EACH UNIT

South Cottonwood

Acreage 71,100

Survey Record	1931	1932	1933
Acres of strip	178	71	166
New attacks per strip acre	.011	-	.026
Attacked trees on unit:			
Lodgepole pine	799	-	-
White-bark pine	-	-	1868
Total	799	-	1868

This unit, whose major drainage is South Cottonwood Creek, embraces the timbered area south of Bozeman to the Squaw Creek divide. Much of the timber at lower elevations is Douglas fir merging into fairly extensive stands of lodgepole pine as the altitude increases and finally into white-bark pine on the high slopes and ridges. The data indicates that the small amount of infestation present on this unit is in the white-bark pine, but there are probably a few lodgepole pine attacked.

Swan-Squaw Creek

Acreage 57,000

Survey Record	1931	1932	1933
Acres of strip	150	306	364
New attacks per strip acre	.033	.063	.033
Attacked trees on unit:			
Lodgepole pine	1186	3370	1519
White-bark pine	678	210	380
Total	1864	3580	1899

Some of the most valuable stands of lodgepole pine on the forest are located on this unit, the plateau between Swan and Squaw Creeks being densely covered with an almost pure stand and extensive areas occurring elsewhere on the unit. Lodgepole pine is the most heavily infested species and a small center of infestation now present on Spring Creek should be

examined annually for indications of increase. A large number of white-bark pine at the head of French, Spring and Butte Creeks, windthrown and broken by severe winds, should be considered as a possible source of infestation for a year or two.

Gallatin Peak

Acreage 88,700

Survey Record	1931	1932	1933
Acres of strip	265	159	199
New attacks per strip acre	.065	.063	.038
Attacked trees on unit:			
Lodgepole pine	5752	5594	2413
White-bark pine	-	-	
Total	5752	5594	3375

Extensive areas of lodgepole pine cover the northern and less rugged portion of this unit, merging into white-bark pine on the steep slopes and high mountains that mark the southern and western boundaries of the unit.

The fire on Placer Creek in 1931 was responsible for the weakening of many trees around its border which were readily attacked by the mountain pine beetle. The small center of infestation which developed showed marked decreases in 1932 and 1933 and should show no heavier infestation in 1934 than is present in the surrounding lightly attacked stands.

WEST GALLATIN RIVER

Acreage 104,200

Survey Record	1931	1932	1933
Acres of strip	355	723	731
New attacks per strip acre	.023	.038	.032
Attacked trees on unit:			
Lodgepole pine	1762	2633	2574
White-bark pine	588	1317	760
Total	2350	3950	3334

Lodgepole pine stands on the northern half of this unit are broken into small bodies of timber due to sharp ridges, untimbered areas, and stands of unsusceptible species. The southern half of the unit supports more extensive stands of overmature lodgepole pine. One area about 1½ miles west of Big Springs has a fairly heavy center of infestation and should be examined annually as the very large overmature lodgepole pine seems exceedingly favorable host material for the development of a barkbeetle outbreak.

PORCUPINE CREEK

Acreage 66,250

Survey Record	1931	1932	1933
Acres of strip	527	408	456
New attacks per strip acre	.021	.035	.026
Attacked trees on unit:			
Lodgepole pine	1383	1953	615
White-bark pine	-	361	1076
Total	1383	2344	1691

The white-bark pine covered ridges enclosing most of the Porcupine Creek drainage support a much heavier infestation than the more extensive lodgepole pine stands at lower elevations.

BIG HORN PEAK

Acreage 26,500

Survey Record	1931	1932	1933
Acres of strip	N	88	177
New attacks per strip acre	o	.025	.182
Attacked trees on unit:			
Lodgepole pine	d	662	312
White-bark pine	a	-	4527
	t		
Total	a	662	4839

This area, now within the new boundary of the Yellowstone Park, has a heavy infestation in the white-bark pine type which is in striking contrast

to the light infestation in the lodgepole pine stands. Although there is much higher proportion of white-bark to lodgepole pine on this unit than on any previously discussed, lodgepole pine still has the greatest volume in the area.

TAYLOR FORK

Acreage 118,500

Survey Record	1931	1932	1933
Acres of strip	506	694	830
New attacks per strip acre	.063	.081	.049
Attacked trees on unit:			
Lodgepole pine	1639	1127	2708
White-bark pine	5852	8445	3161
Total	7491	9572	5869

Extensive stands of overmature lodgepole pine are present over a large portion of this unit which yield to white-bark pine on the higher plateaus and the ridges. The area drained by Lodgepole, Monument, Snowslide, and Bacon Rind Creeks, which have had some centers of infestation indicated a decided decline in the number of attacked trees in 1933.

MINER CREEK

Acreage 71,700

Survey Record	1931	1932	1933
Acres of Strip	551	460	601
New attacks per strip acre	.020	.175	.104
Attacked trees on unit:			
Lodgepole pine	1172	1842	1326
White-bark pine	257	10718	6144
Total	1429	12560	7470

This unit, having the Yellowstone Park as its southern boundary, has a much heavier infestation in white-bark than in lodgepole pine. In both species the 1933 data indicates a much lighter infestation than was present in 1932. Most of the insect activity is concentrated in the portion of the

unit adjoining the Park.

BIG CREEK

Acreage 60,800

Survey Record	1931	1932	1933
Acres of strip	296	137	155
New attacks per strip acre	.033	.032	.078
Attacked trees on unit:			
Lodgepole pine	1022	1935	1982
White-bark pine	1022	-	2773
Total	2044	1935	4755

Again the smaller stand of white-bark pine carries the heavier infestation and seems to be the preferred host. There is considerable untimbered area on this unit which indicates a heavier average attack per acre on the timbered portion than the data show.

MYSTIC LAKE

Acreage 89,900

Survey Record	1931	1932	1933
Acres of strip	N	243	234
New attacks per strip acre	o	.013	.022
Attacked trees on unit:			
Lodgepole pine	d	1195	1933
White-bark pine	a t	-	-
Total	a	1195	1933

A large portion of this unit is untimbered and the remainder contains a timber stand much of which is unsusceptible or too small for insect attack. The lodgepole pine stands have a light infestation which seems entirely endemic in character. No infestation was noted in the small amount of white-bark pine examined.

CABIN CREEK

Survey Record	1931	1932	1933
Acres of strip	698	534	502
New attacks per strip acre	.105	.061	.110
Attacked trees on unit:			
Lodgepole pine	2577	3181	2995
White-bark pine	6828	3885	6528
Total	9405	7066	9523

The upper portions of Tepee, Red Canyon, Cabin, and Beaver Creeks all support considerable infestation in both lodgepole and white-bark pine. The area drained by the headwaters of Cabin Creek is a large basin heavily timbered with lodgepole pine bordered at its upper limits by unusually extensive stands of white-bark pine. Both timber species support considerable infestation with white-bark pine showing much the heavier concentration of attacks. In lodgepole pine attacked trees occur singly, in white-bark pine in groups, which is characteristic for the species over the entire forest.

WEST YELLOWSTONE

Acreage 79,850

Survey Record	1931	1932	1933
Acres of strip	769	670	780
New attacks per strip acre	.046	.044	.015
Attacked trees on unit:			
Lodgepole pine	1038	386	1170
White-bark pine	2596	3090	-
Total	3634	3476	1170

Practically no infestation was noted on the more level areas around West Yellowstone probably due to the severe cold which occurred there in the winter of 1932-33 but on the slopes and ridges surrounding this basin a light endemic infestation remains. In spite of none being found on the strips that were run, there is some infestation in the small amount of white-

bark pine type on this unit.

WEST FORK OF MADISON RIVER

Acreage 127,200

Survey Record	1931	1932	1933
Acres of strip	148	142	329
New attacks per strip acre	.043 *	.023	.127
Attacked trees on unit			
Lodgepole pine	1746	2904	1972
White-bark pine	3742	-	14208
Total	5488	2904	16180

* Too small an amount of data to be representative--Average infestation for entire forest used.

Extensive areas of lodgepole pine occur on the West Fork drainage bordered on the west by comparatively inaccessible, small, scattered stands of white-bark pine. In 1933 more strip was run in the latter type and it is this more representative sample that is responsible for the high average infestation for the unit.

HORSE CREEK

Acreage 48,150

Survey Record	1931	1932	1933
Acres of strip	N	N	279
New attacks per strip acre	o	o	-
Attacked trees on unit:			
Lodgepole pine	d	d	-
White-bark pine	a	a	-
	t	t	
Total	a	a	-

Although the infestation in the fairly heavy stand of lodgepole pine on this unit is undoubtedly very light, it is believed some attacked trees could be found in spite of the fact that none were found on the 35 miles of strip run. It is also probable that the white-bark pine stands along the Gravelly Range support considerable infestation in white-bark pine.

INDIAN-WOLF CREEK

Acreage 91,600

Survey Record	1931	1932	1933
Acres of strip	60	267	212
New attacks per strip acre	.043 *	.081	.100
Attacked trees on unit:			
Lodgepole pine	1258	1117	1307
White-bark pine	2697	6330	7841
Total	3955	7447	9148

* Too small an amount of data to be representative - Average infestation for entire forest used.

Timber stands on this unit are, in general, very limited in extent and confined to the headwaters of the streams. Probably one-half of the area is untimbered and half of the remainder covered with timber unsusceptible to insect attack. The remainder is composed of approximately equal amounts of lodgepole and white-bark pine with the latter type carrying a comparatively heavy infestation. Again white-bark pine seems to be the preferred host as it has about six times as heavy an infestation as the lodgepole pine.

To facilitate comparisons Table I is presented, giving the average infestation per acre and the total for each unit.

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE GALLATIN NATIONAL FOREST

1931 - 1933

Table I

Unit	Average	Number of Attacked Trees			Att. Trees per Acre		
		1931	1932	1933	1931	1932	1933
South Cottonwood	71,100	799	0	1,868	.011	.000	.026
Swan-Squaw Cr.	57,000	1,899	3,580	1,864	.033	.063	.032
Gallatin Pk.	88,700	5,752	5,594	3,375	.065	.063	.038
W. Gallatin R.	104,200	2,350	3,950	3,334	.022	.038	.032
Porcupine Cr.	66,250	1,383	2,344	1,691	.021	.035	.026
Big Horn Pk.	26,500	no data	662	4,839	no data	.025	.182
Taylor Fork	118,500	7,491	9,572	5,869	.063	.081	.049
Miner Cr.	71,700	1,429	12,560	7,470	.020	.175	.104
Big Creek	60,800	2,044	1,935	4,755	.033	.032	.078
Mystic Lake	89,900	no data	1,195	1,933	no data	.026	.021
Cabin Cr.	86,800	9,405	7,066	9,523	.104	.081	.110
W. Yellowstone	79,850	3,634	3,476	1,170	.045	.043	.015
W. Fk. Madison	127,200	5,488(1)	2,904	16,180	.045(1)	.023	.127
Horse Cr.	48,150	no data	no data	0	no data	no data	.000
Indian-Wolf Cr.	91,600	3,955(1)	7,447	9,148	.045(1)	.081	.100
Total	1,188,250(2)	45,629	62,285	73,019	.045	.055	.062
% change in status over preceding year--		----	36.5	17.2	---	20.0	13.0

(1) Original data insufficient to be representative -- used average for forest.

(2) Acreage surveyed in 1933 was 1,188,250. In 1931, 1,023,700. In 1932, 1,140,100.

The general light infestation prevailing over the forest as a whole is readily seen by the data for the various units. White-bark pine carries more than twice the amount of infestation to be found in lodgepole pine even though the former covers a smaller proportion of the total timbered area.

General Notes on the Survey

No evidence was found of the flight of insects in 1933 from other timbered areas into the region surveyed. Such abnormal increases or decreases as the data indicated did occur, could in most cases be credited either to flights between units, to slight differences in the location of strips or to the movement of beetles into trees off the line of strip. With very few trees found on any strip and few strips to a unit, the inclusion or exclusion of a group and in some cases even one tree greatly influences the total number for a unit.

The estimates of the mountain pine beetle infestation on the Gallatin Forest were obtained from 741.2 miles of strip one chain wide, of which about 334 miles were run in lodgepole pine type, 121 in white-bark pine, and 286 in open country or timber type not susceptible to mountain pine beetle attack. On the strip run 326 attacked trees were found of which 215 were white-bark pine and 111 lodgepole pine.

Areas now included in other forests, and adjoining the Gallatin Forest or the Yellowstone Park, are included in the Gallatin estimates rather than attempt to put them under separate headings. These areas include parts of the old Gallatin National Forest now enclosed by the new northwest boundary of the Yellowstone Park, portions of the Beaverhead Forest on the Madison River drainage, and those parts of the Absaroka Forest which adjoin the

north side of the Park on the west side of the Yellowstone River.

In 1933 the survey was made between September 12 and October 7. Favored by generally excellent weather, a smoothly functioning organization, and very few delays, the survey was completed within a few days of the minimum time possible, and with considerable increase in the average amount of strip run per man-day.

In Table II is shown in condensed form an analysis of the results and costs of the Gallatin survey for 1933.

Summary and Analysis of Results and Costs
Survey of Mountain Pine Beetle Infestation on Gallatin National Forest
- 1933 -

Items	Total	Man-days on Project: Effective Field	Man-days on Project: Ineffective Field
Man-days on survey	92	72	20
Miles of sample strip	741.2		
Miles of strip per man-day	8.06	10.29	
No. of sample strip acres per man-day	64.45	82.32	
Acres covered by survey	1,179,840		
" " per man-day	12,820	16,380	
Mileage covered by car	1,446		

Total Cost of Survey

Labor	$398.53
Transportation (car)	26.10
Subsistence	224.45
Equipment	-----
Telephone & Telegraph	-----
Total	649.08

Cost of Survey Distributed

Cost per man-day	$7.055
" " mile of strip	.876
" " sample acre	.109
" " acre of region surveyed	.00055
Percent of total area actually covered	.503

Ineffective Time as follows in Man-days:

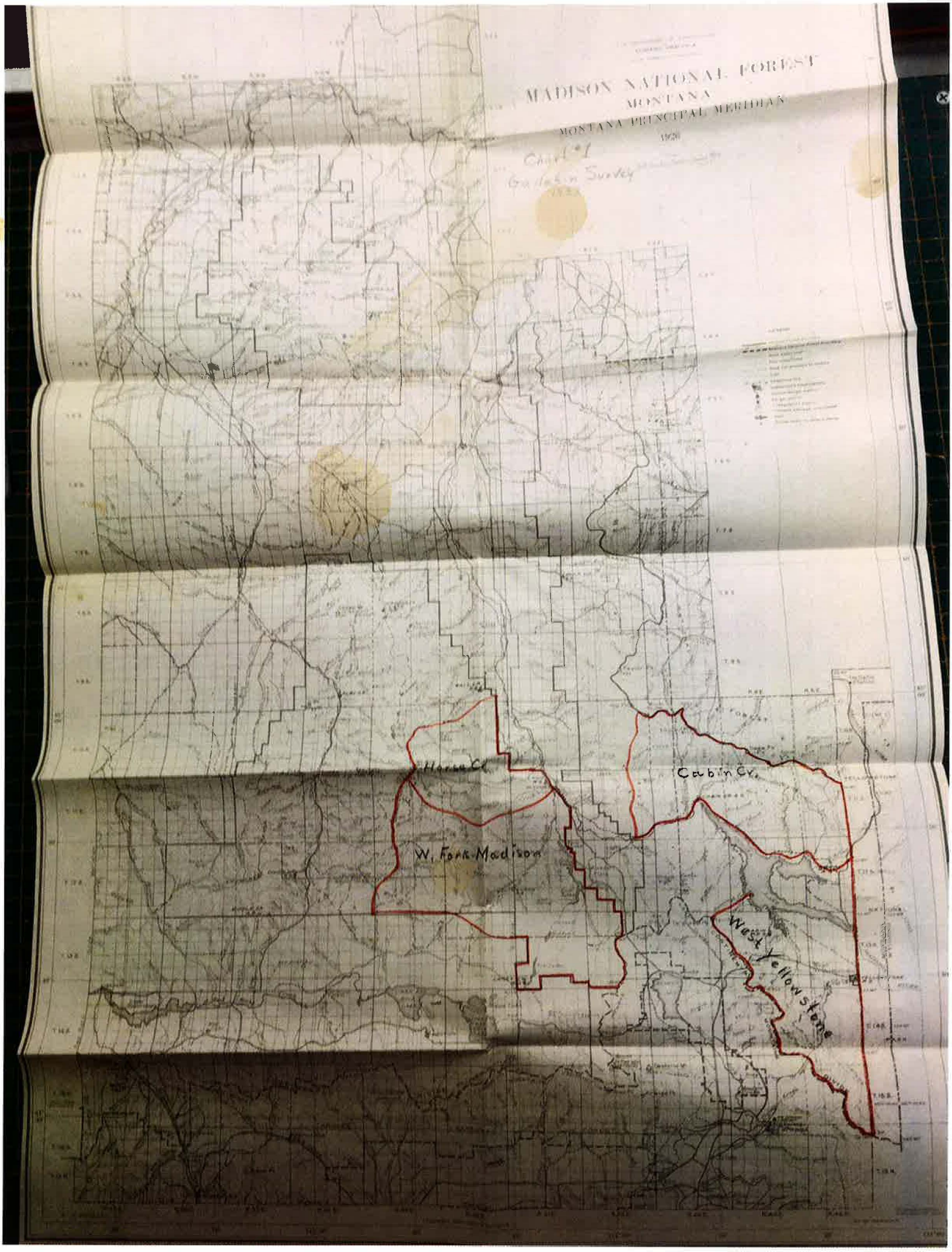
Travel	12	To and from, and on project
Sickness	none	
Bad weather	8	

The more important findings revealed by this survey are as follows:

(1) Over the forest as a whole the 1933 mountain pine beetle infestation is only slightly more than that of 1932.

(2) The decrease in the infestation in lodgepole pine is believed to be due to the effect of severe cold during the winter of 1932-33. Increases in the infestation in white-bark pine indicate that the severe cold was not as effective on the white-bark pine sites.

(3) No indications were found that any of the 1933 infestation had been caused by the flight of beetles into the Gallatin Forest from distant sources. Local infestation seems to have been responsible for most of the increases noted.


MADISON NATIONAL FOREST
MONTANA
MONTANA PRINCIPAL MERIDIAN
1920
Chart #1
Gallatin Survey
Horse Cr.
Cabin Cr.
W. Fork-Madison
West Yellowstone

GALLATIN NATIONAL FOREST
MONTANA
MONTANA PRINCIPAL MERIDIAN
Gallatin Survey
1933
Mult. Lake
S. Cottonwood
Gallatin Pk.
Swan Squaw
Big Creek
W. Gallatin
Porcupine
Indian Water
Big Horn
Cabin Cr.
YELLOWSTONE
NATIONAL
PARK
MONTANA
WYOMING
ABSAROKA
MADISON NAT'L FOR
Longitude West from Greenwich